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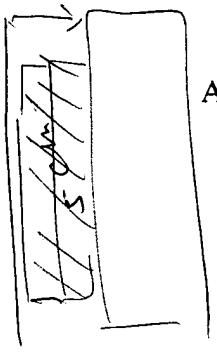
STRUCTURE FOR PURIFYING EXHAUST GAS

[*Haikigasu jyohkayoh kohzohbutsu*]



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[*There are no amendments to this patent.*]

Specification

1. Title of the invention

Structure for purifying exhaust gas

2. Claim of the invention

(1) In a structure for purifying exhaust gas consisting of a ceramic honeycomb having many cells inside, a buffer material wrapped around the outer circumference of the above-mentioned ceramic honeycomb, a metal container housing the above-mentioned buffer material and having the exhaust gas inlet port facing the front and back sides of a ceramic honeycomb structure, a structure for purifying exhaust gas characterized by the fact that many holes and/or grooves are formed in the above-mentioned buffer material at least in the area that comes in contact with the ceramic honeycomb.

(2) The structure for purifying exhaust gases described in Claim 1 in which a mixture of an inorganic fiber, vermiculite, and an organic binder are used as the main components of the composition.

(3) The structure for purifying exhaust gases described in Claim 1 in which many grooves are formed in the flat surface of the buffer material.

3. Detailed description of the invention

Field of industrial application

The present invention pertains to a structure for purifying exhaust gases used for catalytic converters or filters used for purification of the exhaust gases of internal combustion engines.

Prior art

In recent years, catalytic converters and filters made of a ceramic honeycomb are installed in the exhaust pipe for purification of exhaust gases of internal combustion engines. In the above-mentioned ceramic honeycomb, a ceramic is formed into a honeycomb structure by means of extrusion molding or a corrugator process. The catalytic converter is used for oxidizing hydrocarbons and carbon monoxide included in the exhaust gases of gasoline engines, and a precious metal catalyst such as platinum is deposited on the ceramic honeycomb which has a relatively high cell density. Filters are mainly used for diesel engines and are used for removal of particulates (smoke) included in the exhaust gas, and one end of the cell of the ceramic honeycomb made of a material having a relatively high porosity and relatively loose cell density and the other end of the cell next to the above-mentioned cell is closed with a plug and the filter has a structure such that the exhaust gases that enter cannot escape unless the exhaust gas passes through the walls of the cells.

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In either case, the outer circumference of the ceramic honeycomb is wrapped with a buffer material such as an inorganic fiber mat or waveform mesh structure, and is housed in a metal container having connection ports for the exhaust gas at the front and back.

Problems to be solved by the invention

When the above-mentioned ceramic honeycomb product is installed in the flow path of the exhaust gas from an internal combustion engine, and back pressure is applied due to the ventilation resistance and the ceramic honeycomb is pushed toward the back. Thus, the above-mentioned buffer material is used not only to protect the ceramic honeycomb from external mechanical vibrations but also to hold the ceramic honeycomb in place. However, in order to hold the ceramic honeycomb in place with sufficient force to resist the above-mentioned back pressure, a buffer material with high-density and high hardness is required. When high-temperature exhaust gases flow into the ceramic honeycomb or vermiculite, the gases inside are burned, and the heat is transferred to the above-mentioned buffer material and a significant temperature change occurs between the center area and the outer circumference of the ceramic honeycomb. As a result, a high tensile stress is applied to the outer circumference based on thermal expansion of the interior. The ceramic is not capable of withstanding the above-mentioned force and ring-form cracks, referred to as ring-off, are formed at the outer circumference.

The objective of the present invention is to produce a structure for purifying exhaust gases capable of securely holding the ceramic honeycomb inside the container, and an arrangement is made so that formation of ring-form cracks does not take place even when the center area is heated to a high temp, and for which the initial shape of the structure can be maintained for efficient purification of the exhaust gas.

Means to solve the problem

In the present invention, an inorganic fiber and an organic binder are used as the main components and a thick sheet having many holes and/or grooves are formed on the surface, and the above-mentioned sheet is wrapped around the outer circumference of the ceramic honeycomb used for purification of exhaust gases as a buffer material, and pressure is applied to the ceramic honeycomb from outside the sheet in the radial direction and is housed in the container connected to the engine exhaust pipe.

Work of the invention

According to the above-mentioned structure, the friction force with the outer circumference of the ceramic honeycomb is increased as a result of many holes and/or grooves formed in the surface of the buffer material that prevent the ceramic honeycomb from being pushed down stream. Furthermore, many holes or grooves are formed in the buffer material, thus, the overall density is reduced. As a result, heat conduction toward the outer circumference is reduced, and heat release to the outside via the container is blocked even when the ceramic honeycomb is heated with a high-temperature exhaust gas or high-temperature combustion gas from the engine; thus, the internal temperature difference generated is insignificant. As a result, the thermal stress generated at the outer circumference of the ceramic honeycomb is reduced, and deformation that causes cracking inside does not take place.

Application examples

In the following, the present invention is explained in further detail with drawings of an application example of the structure for purifying exhaust gases of the present invention.

Fig. 1 is a structure for purifying exhaust gases used for removal of particulates included in the exhaust gases of a diesel engine, and is a vertical cross-section view when the structure is connected to the exhaust pipe of an engine (not shown in the figure). In the figure, 1 is the ceramic honeycomb cylinder. The ceramic honeycomb is a structure having cell walls 3 that form cells 2 (2a, 2b) that form internal paths. One end of cell 2a and the opposite end of adjoining cell 2b are sealed with plugs 4. Buffer material 5 is wrapped around the outer circumference of the ceramic honeycomb and the unit is housed in container 6 made of a heat-resistant stainless steel. The buffer material is produced by mixing a thermally expansible vermiculite, inorganic fiber, and an organic binder and performing a wet molding to produce a sheet having many holes on the surface. A heat treatment is performed for the above-mentioned structure at approximately 400°C and expansion of the vermiculite included in the buffer material is carried out and the ceramic honeycomb is compressed in the radial direction. Both ends of container 6 are tapered to form a corn-shape, and one end is used as the engine connection port 8, and the other end is used as the muffler connection port 9. Stoppers 10a and 10b are welded inside container 6 so as to fasten the buffer material in the front and back of the ceramic honeycomb.

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Operation of the structure of the above-mentioned application example is explained below. First, normal operation time of the diesel engine is explained. Upon operation of

the engine, an exhaust gas containing particulates flows into the above-mentioned engine connection port 8 connected with the exhaust pipe of the diesel engine. The exhaust gas then enters cells 2a having openings on the end toward the engine connection port 8 and the exhaust gas further enters cells 2b having openings on the end toward the muffler connection port 9 by passing through cell walls 3. In this case, the particulates included in the exhaust gas cannot pass through the cell wall and are left behind in cell in the openings on the side toward the engine connection port 9 [sic] and accumulate there. Meanwhile, upon removal of the particulates, the clean exhaust gas enters muffler connection port 9, and is released into the air via the exhaust muffler. As accumulation of the particulates continues as described above, and the ventilation resistance of the ceramic honeycomb slowly increases as a result of clogging by the particulates, and pushes the ceramic honeycomb backward with the increase in backing pressure. However, the high friction force between the outer circumference of the ceramic honeycomb and the surface of the buffer material having many holes resists the above-mentioned force and the ceramic honeycomb is retained in place. Then, when an adequate amount of particulates is accumulated inside the ceramic honeycomb and the condition reaches the point where additional accumulation of particulates has an adverse effect on the engine, regeneration starts. In regeneration, first, the intake port of the diesel engine is reduced so as to form the engine under an overload state. When the above-mentioned state is retained for 5 minutes, the temperature of the exhaust gas reaches 600°C or higher. And the temperature inside the ceramic honeycomb reaches approximately 600°C and the particulates accumulated inside begin to burn. In this case, the internal temperature of the ceramic

honeycomb reaches 800°C to 1000°C. Heat is released to the outside from container 6 via the buffer material but the degree of release can be controlled to a relatively low value based on air insulation produced by the many holes formed in the buffer material. Thus, the temperature difference between the center area and the outer circumference of the ceramic honeycomb can be maintained within 200°C and mechanical dislocation produced in the outer circumference based on thermal expansion of the center area can be controlled to a low level.

As a result, breakage of the ceramic honeycomb at the downstream end of the container is absent. Furthermore, formation of cracks at the outer circumference of the ceramic honeycomb can be eliminated, and breakage can be prevented even under conditions where a sudden increase in temperature is repeated inside the exhaust gases of the internal combustion engine.

In this case, the same good effect can be achieved when the buffer material has a structure where many fine grooves formed diagonally on the surface as in the case of Fig. 2.

Effect of the invention

According to the present invention, an adequate force capable of resisting the back pressure of the exhaust gas can be achieved when many holes or grooves are formed in the surface of the buffer material installed between the ceramic honeycomb and the container that houses the ceramic honeycomb. Furthermore, the energy of the heat released outside can be reduced by the air insulation formed at the cross section of the buffer material and

difference in temperature between the inside of the ceramic honeycomb and the outer circumference of the ceramic honeycomb can be reduced and the degree of dislocation due to the tensile force applied in the axis direction at the outer circumference based on the internal thermal expansion can be reduced, and formation of cracks in the outer circumference can be eliminated.

4. Brief description of figures

Fig. 1 is a vertical cross-section view of the structure for purifying exhaust gases of the present invention, and Fig. 2 is a perspective view that shows assembly of the structure for purifying exhaust gases of a different application example of the present invention.

1: Ceramic honeycomb

2: Plug

5: Buffer material

6: Container

7: Holes

11: Grooves

Agent: Shigetaka Awano, Patent attorney, et al.

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Fig. 1

1: Ceramic honeycomb

2a, 2b: Cells

3: Cell wall

4: Plug

5: Buffer material

6: Container

7: Holes

8:

9:

10a, 10b:

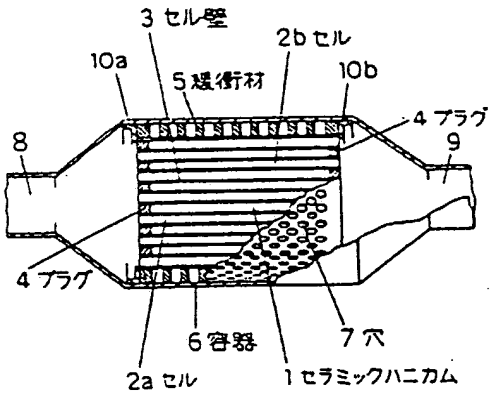
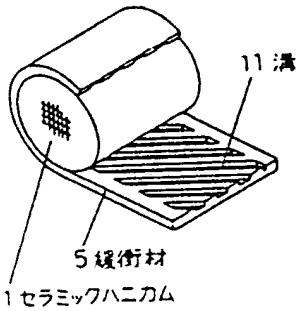


Fig. 2

1: Ceramic honeycomb

5: Buffer material

6: Groove



Do acts of public use or sale in the United States of an invention preclude patentability if the acts occur more than one year before the applicant's actual United States filing date but less than one year before the applicant's properly claimed foreign priority date?

(A) Yes

(B) No

Chapter 17, Question 26a

The question appearing in the Question tab is based on the following fact pattern. All other questions based on the same fact pattern (not yet answered correctly) will follow in order. You can use the New Question, Back, and Forward buttons to view these related questions. For complex or illustrated fact patterns, you may find it helpful to refer to the corresponding question in the Patent Practice treatise.

Applicant Green conceived a self-waxing widget on February 6, 1982. On February 15, Green flew to Florida and began an extended vacation at the beach, which lasted until September 21, 1982. On October 3, 1982, Green reduced the self-waxing widget to practice and filed an application for patent in the PTO on December 1, 1982. All the acts stated took place in the United States.

Chapter 17, Question 26a

A Canadian patent that issued November 1, 1982, based on an application filed January 16, 1981 and that claims priority based on an abandoned U.S. application filed January 17, 1980, properly can be removed as a reference by an affidavit showing the facts set forth in the fact paragraph above.

(A) True

(B) False

Chapter 17, Question 25a

The question appearing in the Question tab is based on the following fact pattern. All other questions based on the same fact pattern (not yet answered correctly) will follow in order. You can use the New Question, Back, and Forward buttons to view these related questions. For complex or illustrated fact patterns, you may find it helpful to refer to the corresponding question in the Patent Practice treatise.

Consider each question independently of the others. In the United States, Smith, your client, conceived a coating composition and coating apparatus on March 6, 1968. While not diligent, he actually reduced the composition and apparatus to practice on April 20,